

# Economic growth: Further thoughts

EC 235 | Fall 2023

# Materials

Required readings:

- Blanchard, ch. 11.

# Prologue

# Prologue

Last time, we derived two relations involving aggregate output per worker ( $Y/N$ ) and an economy's capital stock per worker ( $K/N$ ):

$$1. \frac{Y}{N} = F\left(\frac{K}{N}, 1\right) = f\left(\frac{K}{N}\right)$$

$$2. \frac{K_{t+1}}{N} - \frac{K_t}{N} = s \frac{Y_t}{N} - \delta \frac{K_t}{N}$$

# Prologue

$$\frac{Y}{N} = F\left(\frac{K}{N}, 1\right) = f\left(\frac{K}{N}\right)$$

The first relation defines the *long-run aggregate production function* only depending on the economy's *capital intensity* (or *capital per worker*).

# Prologue

$$\frac{K_{t+1}}{N} - \frac{K_t}{N} = s \frac{Y_t}{N} - \delta \frac{K_t}{N}$$

The second relation gives the *law of motion of capital*: capital per worker depends on two factors:

1. Investment per worker: since  $I = sY_t$  and given the saving rate  $s$ , output per worker determines the amount of *saving* per worker and thus the *investment* per worker;
2. Depreciation per worker: the capital stock per worker determines the amount of *depreciation* per worker.

# Capital and output dynamics

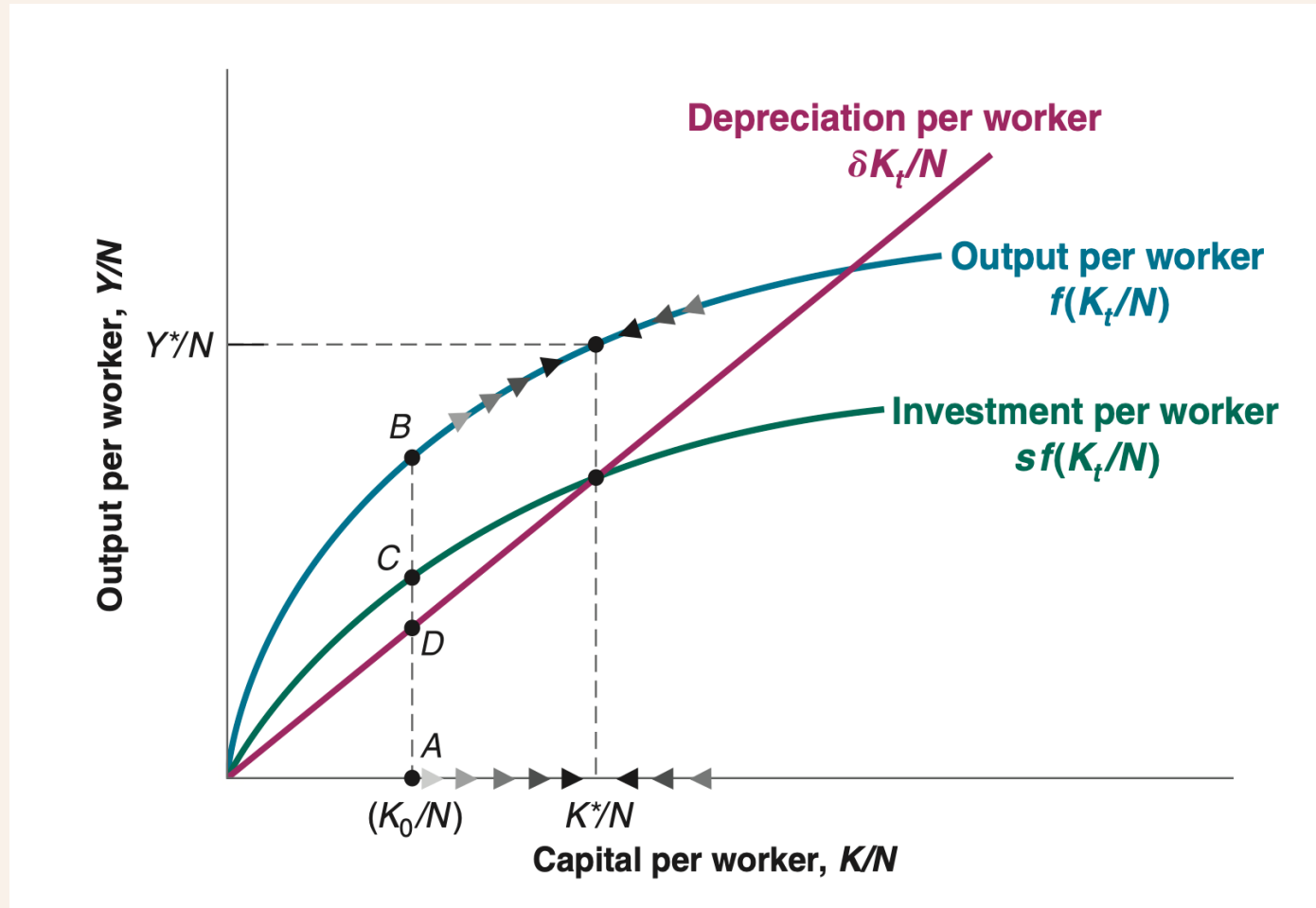
# Capital and output dynamics

Given the two relations, we can further understand the dynamics of capital and output over time.

The *easiest* way to do so is through a graph.



# Capital and output dynamics



# Capital and output dynamics

The state in which output per worker and capital per worker are no longer changing is called the *steady state* of the economy.

In mathematical terms, the steady state is reached when there is no change in the capital stock per worker:

$$\frac{K_{t+1}}{N} - \frac{K_t}{N} = s \frac{Y_t}{N} - \delta \frac{K_t}{N} \implies 0 = s \frac{Y_t}{N} - \delta \frac{K_t}{N}$$

$$s \frac{Y_t^*}{N} = \delta \frac{K_t^*}{N}$$

# Capital and output dynamics

As  $\frac{Y}{N} = f\left(\frac{K}{N}\right)$ , we can write the steady state as:

$$sf\left(\frac{K^*}{N}\right) = \delta \frac{K^*}{N}$$

# Sources of growth

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Now that we are aware that there exists a possible *steady state* of economic growth, what are the *sources* of economic growth over the long-run?

A few candidates:

1. The capital intensity;
2. The savings propensity  $s$ ;
3. Consumption (“golden rule”);
4. Technological progress.

Let us think about each of them.